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Redesigning Hospital Documentation Systems to Improve the Quality of Obstetric Patient Records in Ecuador

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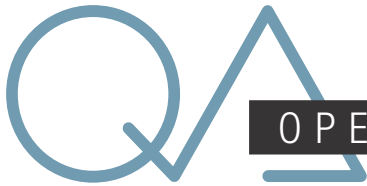
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Abstract

This study tested whether a redesign methodology would improve the quality of medical records in the obstetric services of four Ecuadorian hospitals. Quality teams in each hospital implemented a redesign methodology, working in cooperation with local quality assurance (QA) experts from the QA Project and following a predetermined sequence of steps. Eight quality standards for medical records were defined: (1) complete set of forms, (2) correct chart headers, (3) complete discharge summary, (4) complete delivery form, (5) patient consent, (6) identification number on admission and discharge forms, (7) legibility, and (8) coherency and consistency. Pre- and post-samples of medical records (448 before and 459 after) were audited to determine compliance with the eight standards. The average increase in the eight indicators for the four-hospital pooled sample was 27 percentage points, up from 41 percent compliant in the pre-sample to 68 percent in the post-sample. Five of the indicators showed highly significant gains of 25 percentage points or more, with four of them attaining post-intervention compliance of 80 percent or more. Across the four hospitals, pre-intervention average compliance ranged from 27 to 49 percent; the average gain ranged from 24 to 31 percentage points. The gain at each hospital was statistically significant, but the differences among the hospitals were not.

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Abstract Continued

A secondary purpose of the study was to test and improve the redesign methodology. The study was carried out sequentially, one hospital at a time: participants made recommendations for improving the methodology, those recommendations were used to modify the methodology, and the modified version was used at the next hospital. In effect, although small modifications were made to the redesign methodology as the study progressed, there was no evidence that these modifications improved compliance with the standards.

Prior to redesign, the quality of the obstetric medical records was very poor, well under 50 percent compliance. Such poor documentation is not suitable for use in quality assessment or for proper management of patients. The systematic and participatory redesign methodology applied in this study was very successful in increasing the quality of the medical records, especially for the indicators of completeness, legibility, and coherency, but less so for indicators related to patient signature and patient identification number. Future research is needed to test whether the improved quality of these records is adequate to monitor changes in the quality of obstetric care.

Acknowledgements

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The redesign intervention was done by the redesign team at each participating hospital with input from the QA facilitators who organized and facilitated workshops in each hospital; most were QA experts from the QA Project office in Quito. Data collection tools were designed and data collection carried out in Ecuador by in-country research staff. Analysis of the data and preparation of the final report was done by members of the QA Project research staff in Quito and Bethesda.

The authors of this report comprised the in-country research team: Angela Bermeo was the study coordinator and principal investigator; Patricio Romero was responsible for the data collection and served as unofficial deputy coordinator. Paul Richardson and Jorge Hermida of CHS were instrumental in the original conception and research design. Joanne Ashton of Joint Commission International (JCI) provided guidance along the way and was instrumental in structuring the final report. Bart Burkhalter of CHS also assisted in preparing the final report.

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Redesigning Hospital Documentation Systems to Improve the Quality of Obstetric Patient Records in Ecuador

Angela María Bermeo and Patricio Romero

1. Introduction

A. Background

The aim of this study was to explore methods that might improve documentation of obstetric care in Ecuadorian hospitals. In 1995, the Ecuador Ministry of Health had begun receiving technical assistance from the Quality Assurance (QA) Project, and since that time, various quality projects had been conducted in hospitals throughout the country. Quality assurance depends on the availability of accurate data. While working to improve quality in Ecuadorian hospitals, many problems with the documentation systems were uncovered: missing and incorrect data, duplication of patient records, and illegible entries. The poor quality of the records meant that they could not be used as reliable sources of information for quality improvement efforts and should not be used in making decisions about healthcare. Consequently, the QA Project proposed a redesign initiative to improve the documentation system.

Physicians and nurses typically prefer providing direct patient care to working on support systems, so they tend to balk when told to

improve or increase their documentation efforts. At the same time, they agree that having client data available is crucial to making effective healthcare decisions. When the patient's history, physical, or lab results are not available, it is difficult to make a diagnosis, determine a course of treatment, or regulate medications. When information is missing, different providers waste time and resources when they have to repeatedly request that information from the patient. When physician's orders are illegible, errors can be made in providing treatment, such as giving the wrong medication to the patient. The lack of correct and timely data can lead to poor choices in clinical practice, medication errors, inappropriate repeating of tests, unnecessary referrals, and generally, the waste of time and other resources.

The format selected for documentation also may contribute to documentation woes. Some forms are too complicated. Or the same information may be required on various forms in the same medical record, creating extra work for the staff and sometimes inconsistent information. The information used for clinical decision making is often the same as is used for quality improvement activities. Trends in patient care and treatment—including diagnosis, interventions, and response to care—can be monitored to measure effectiveness, but when this informa-

Abbreviations

CHS	Center for Human Services
ID	Identification
JCI	Joint Commission International
MOH	Ministry of Health
MR	Medical Records (department)
pp	Percentage point(s)
QA	Quality assurance
USAID	U.S. Agency for International Development

tion is lacking, quality improvement teams find it difficult to identify opportunities for improvement.

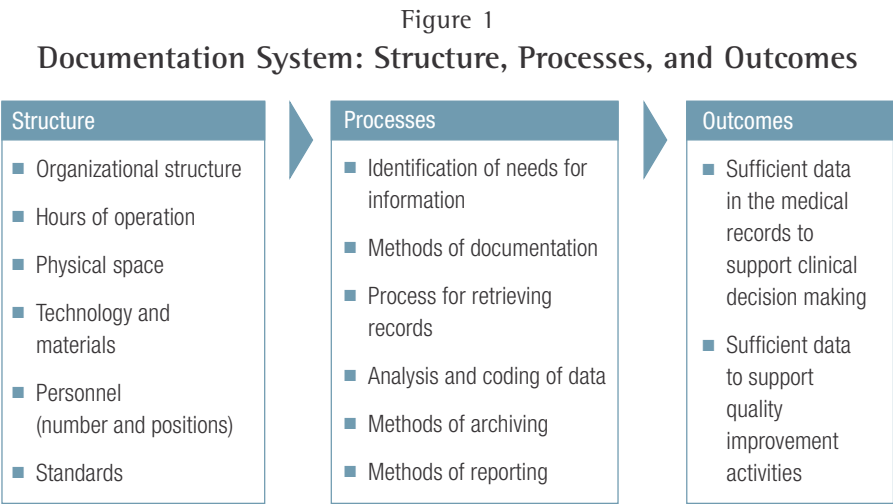
Clearly, documentation may not be the most glamorous aspect of hospital practice, but streamlining and improving the process is crucial in improving the quality of care.

B. Definition of Redesign Methodology

Redesign methodology has been applied in hospitals throughout the United States. Redesign takes a fresh look at the process rather than simply correcting individual problems. In the particular method used in this study, a multidisciplinary team of people who are involved in the process work together to rethink the process and propose a new one.

Inasmuch as the redesign method involves examining systems and processes, a documentation system can be viewed in terms of its structure, processes, and outcomes (Figure 1). The structure of the system describes the organizational support for the system: staffing, physical space, forms, etc. The processes involved in documentation include such activities as chart retrieval, filing, and documentation methods. Outcomes include having sufficient and accurate data with which to make clinical decisions and support quality improvement. Therefore, when redesigning a system, the quality team considers the structure, processes, and outcomes desired in the new design.

As part of the redesign methodology used here, existing documentation standards were reviewed and revised, and new standards were developed. The quality teams were interested in improving adherence to



the standards and refining the methods used to sustain such adherence.

C. Research Hypotheses

The working hypothesis of the study was that the redesign method would result in improved compliance with documentation standards in obstetrics. Pre- and post-intervention measures were used to gauge the effect of the redesigned documentation system on compliance with documentation standards. A secondary hypothesis was that learning would transfer from one hospital to the next, resulting in improvements in the redesign methodology.

II. Description of the Interventions

A. Redesigning and Implementing New Documentation Systems

The redesign methodology for this study was systematic. There were three major stages: (1) a preliminary

stage that defined the focus of the project and identified the study hospitals and quality teams, (2) the redesign stage in each hospital, and (3) the implementation stage in each hospital. The redesign stage had two phases: first an assessment of the current system and needs and then a redesign of that system. The steps in all three stages are shown in the sidebar and detailed below. This process is similar to other redesign models in the QA literature (Plsek 1993; Hermida et al. 2000).

The redesign methodology was also participatory: it was carried out by facility-level teams with support from one or more quality assurance experts. The notion was to directly involve the primary users of the information (the providers) in the identification of needs, in the formulation of a workable redesign strategy for the institution, and then in the redesign and implementation of a better system.

Stage 1: Preliminary planning.

In this step, hospitals would be selected, the scope of the effort would be determined, and team composition would be decided.

Steps of Redesign Methodology
Stage 1. Preliminary planning (1) Decide on focus (e.g., documentation of obstetric care) (2) Select hospitals (3) Form teams in each hospital
Stage 2. Apply the redesign method in each hospital Phase A: Describe current system, clients, and needs (1) Review and adapt the generic redesign methodology (2) Describe current system and its clients (3) Determine needs and expectations of clients Phase B: Design the new system (1) State aims of new system (2) Develop flowcharts for new system (3) Match client needs to flowcharts (4) Identify desired features and limitations of new system (5) Describe new design (6) Identify and address barriers to implementation (7) Develop and initiate an implementation plan
Stage 3. Implement in each hospital (1) Implement the new system according to plan (2) Design and implement a system to monitor the results of the new design

Four hospitals were selected to participate in the study: Riobamba General Hospital in the Province of Chimborazo, Ambato Provincial Teaching Hospital and Pillaro District Hospital in the Province of Tungurahua, and San Vicente de Paul Hospital in Ibarra, Province of Imbabura. These hospitals were selected purposively to represent different geographic locations and levels of complexity (Table 1). All selected hospitals had plans to develop quality assurance programs; they also had hospital directors and key personnel who supported the redesign study.

Inasmuch as other quality efforts in the country were focused on obstetric care, the QA Project in collaboration with the Ministry of Health decided to concentrate on obstetric documentation, focusing on

clinical information that served clinical, administrative, and quality improvement needs.

At each hospital, redesign team members were recruited from those who expressed interest in participating and who represented the different phases of the documentation process. The teams typically consisted of physicians and nurses from the obstetric, pediatric, neonatology, and emergency departments, as well as medical records staff, social services staff, and hospital administrators. QA facilitators trained hospital teams in quality concepts and the redesign methodology. The facilitators then guided the teams through the redesign process on a regularly scheduled basis, as described below.

Stage 2: Apply the redesign method, Phase A: Describe current system, clients, and needs. The early steps in the redesign stage established the foundation for the redesign in each hospital. Information was collected regarding the current state of the documentation system. A description of the structures that support the system—such as the physical space for maintaining medical records, staff competency in medical records management, and current standards—provided an overview of the system. Baseline data were collected in order to assess the documentation system against national and international standards for medical record departments.

Standards for information management included: (a) information content and use, and (b) information

Table 1
Type, Size, and Location of Study Hospitals

Hospital	Type	Beds	Annual Admissions (1999)	Annual Deliveries (1999)	Province
Riobamba	General hospital	220	7,677	2,902	Chimborazo
Ambato	Teaching hospital	386	7,684	2,402	Tungurahua
Pillaro	District hospital	28	577	265	Tungurahua
Ibarra	Provincial referral hospital	166	7,356	2,872	Imbabura

management.¹ The former included:

- Easy access to and use of data and information are available to those who need them
- Data sets, data definitions, codes, classification, and terminology are standardized whenever possible
- The degree of accuracy and completeness meets intended use
- Reporting of data and information is accurate and in a format that meets user needs
- Monitoring of information management processes and outcomes supports the identification of opportunities for improvement

Information management included:

- Records and information are protected against loss, destruction, tampering, and unauthorized access or use
- Staff are trained and competent in the fundamentals of medical record documentation
- Data are collected and reported in a timely, efficient manner

These standards provided the basis for: (a) determining the documentation system redesign strategies, and (b) measuring the performance of the healthcare providers and medical record staff. Problems identified during the record review included:

- Records were missing forms, leaving sets of information incomplete
- Documentation was not legible

- Patient identification data were missing from chart forms
- Documentation was not complete (discharge form, delivery record)
- Proper signatures were missing (consent forms, physician orders, and discharge forms)
- Information was not consistent throughout the record
- Duplicate medical records were found
- Use of abbreviations varied

A key element of the redesign methodology is determining the needs and expectations of clients. Typically, both internal and external clients are identified. In the case of the documentation system, internal clients include individuals who provide or use information in the clinical records, such as physicians, nurses, administrators, and medical record staff. External clients include patients and family members who interface with the system. In this phase of the redesign methodology, the hospital redesign teams collected data through focus group discussions and interviews.

The various needs of the clients became the driving force of the redesign. For instance, physicians identified the need to have access to medical records 24 hours a day, because patients arrive at the hospital at any time and the previous record is important for understanding a patient's history and earlier treatment. Table 2 shows what clients need from the documentation system.

All healthcare providers expressed a need for information that was easy to find (e.g., common forms, consistent order within the chart), legible, and complete. Healthcare staff also indicated that an effective documentation system required up-to-date written policies and procedures, training, and supervision.

Stage 2 (Apply method); Phase B: Redesign the new system.

The steps of the redesign process are arranged to lead the team from one step to the next, one building on the other so that the designs are well constructed and reflect the needs and expectations of the clients. The team began their design work by reviewing the results of the clients' needs assessments. They also sought information about current standards for documentation systems that had been developed locally or internationally. Team members studied the best practices of other organizations with regard to documentation systems ("benchmarking"), which helped them "think outside the box."

Based on the information and discussions, the team operationally defined key concepts of the design (e.g., client focused, continuity). The teams learned of limitations for the new design (e.g., financial limitations, aspects that could not be changed). They then identified highly desired features that they wanted to "design in." These included features that currently worked well and that the team wanted to continue, and new ideas that were identified through benchmarking or creative thinking.

¹ This is an illustrative list of standards that can be applied in most health information systems. The final list of standards is unique to the particular hospital and information system. One result of the study was a newly revised set of standards for collecting, archiving, processing, and using information in patient records at each of the hospitals studied.

Table 2
Client Needs (Four Hospitals)

Client	Needs Identified
Diagnostics (lab, X ray)	Requisitions that are complete and legible
Hospital directors	Complete and accurate data to monitor quality indicators Typed monthly reports
Medical record staff	Expertise in disease classification/coding Definitive diagnosis by attending physician Computerized health information system Adequate space for preparing and archiving records Security of archives
Nurses	Fewer forms and less duplication of information Availability of forms Integration of record
Patients	Friendly, helpful staff Flexible, timely admission process Continuity of care (same practitioner) Confidentiality Accurate and timely lab/test results Ability to locate services
Physicians	24-hour access to medical records Key information about patients who are transferred between facilities
Specialists	Complete information regarding diagnosis and treatment Clear discharge summary

A general first-level flowchart was used to define the future state of the documentation system (Figure 2). A more detailed second-level flowchart was then developed for each step in the new process (Figure 3). Inasmuch as implementing a new process can be fraught with problems, the team considered potential problems in implementing the new design and developed strategies to avoid them.

Data were collected during this phase to assess the feasibility of some aspects of the new design. For instance, to assess the feasibility of an additional medical record storage area, one team collected more data on the number of records to be stored, personnel available to retrieve them, locations available, and cost; the team then considered its options to determine a design that was practical and affordable.

The final step of the redesign process is to develop and initiate a plan to implement the new system. Implementing the redesign requires

Figure 2
Example of First-Level Flowchart for Obstetric Documentation Process

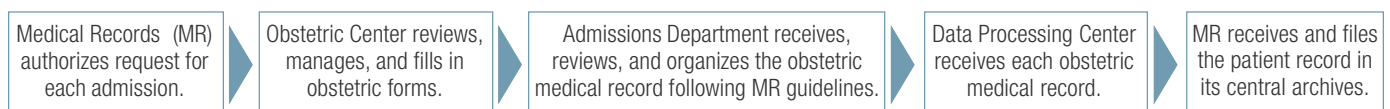
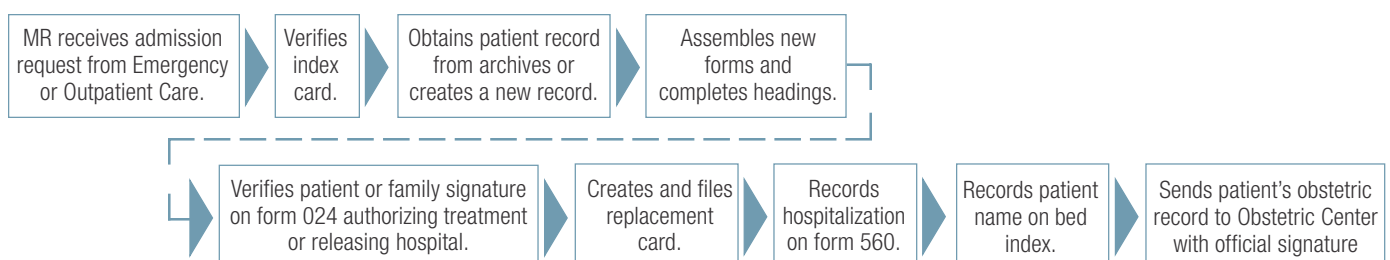


Figure 3
Example of Second-Level Flowchart for “MR Authorizes Admission” Process



careful planning and execution. The QA facilitators guided the team through developing an implementation plan that included identifying the resources needed to support the design and the activities necessary to complete the implementation, assigning responsibilities, and the cost of each activity.

Each hospital redesign team received training in the ten redesign steps of stage 2 in a series of workshops held at the hospital. Each workshop addressed one of the ten steps, starting with training in the step and then proceeding to implementing the step by the team. The workshops were about two weeks apart and lasted about four hours. Each was facilitated by a two-member team. The facilitators were health professionals (three nurses and one statistician) familiar with QA and redesign methods who had worked in hospitals and managed clinical records. After each workshop the participants were asked to complete a written evaluation of the facilitators' work, which the facilitators reviewed and used to improve the next workshop.

Stage 3: Implementation. Once the new design was implemented, each team established a method to monitor the results of the redesign initiative. New processes often require refinement, so the teams continued to meet to evaluate the institutionalization of the new process. Perseverance was important: changing standards and practices requires commitment on the part of hospital management and staff. Old habits must be changed and new ones formed. Consequently, change requires time and perseverance not only to implement the change but also hold the gain. Monitoring of the new design should

be continued until the new standards and practices are well ingrained into the practitioners' daily lives.

B. Improving the Redesign Methodology

As the ten redesign steps of stage 2 were applied in each hospital, the redesign methodology was assessed by each hospital redesign team and independently by the QA facilitators. They identified problems and made recommendations for improving the methodology in future applications at other hospitals. In Riobamba, the first hospital, the assessment was done only once, at the completion of stage 2. In the other three hospitals, the assessment was done three times, after steps 4, 8, and 10. The idea was that the QA facilitator from the central research staff would carry recommendations from the assessments to the next hospital for consideration by the redesign team there. As seen in Table 3, the redesign methodology was applied at the same time in Ambato and Pillaro hospitals, so there were only two hospital-to-hospital transfers of learning.

III. Research Methods

A. Qualitatively Documenting the Improvements and Recommendations

The authors interviewed the hospital redesign team members and QA facilitators. The interviews used a structured questionnaire with multiple choice and yes-no questions that probed specific issues about the research methodology and workshops. The authors also led focus groups with the redesign teams. The purpose behind gathering this information was to: (a) document the specific structural and process improvements made in each hospital's documentation system as a result of the redesign process, and (b) document each redesign team's recommendations for changes in the methodology.

Some of the interviews were audio-recorded and others recorded in traditional written form. The interview and focus group data were entered and analyzed using NUD*IST. The authors analyzed some interviews directly from the audio-tapes.

Table 3
Schedule of Events by Hospital

Hospital	Baseline Data Collected	Redesign Workshops	Redesign Completed
Riobamba	August 1999	September 1999–January 2000	February 2000
Ambato and Pillaro	September 1999	October 1999–April 2000	April 2000
Ibarra	May 2000	May–July 2000	July 2000

B. Quantitatively
Evaluating the Impact
of the Redesign Process

Each hospital used a retrospective pre- and post-audit of a sample of medical records to determine if the redesigned system improved the

quality of the medical records. During a redesign process, many aspects of the system may be changed, so it is difficult to show a relationship between a specific element of the new system and the overall impact. In this study, the measurement of the effect of the

redesign was based on comparing the baseline data to the post-intervention data with respect to eight indicators of quality. The eight indicators measured the adherence of completed medical records to the eight documentation standards in Table 4. Partial information was

Table 4
Indicators of the Quality of Medical Records

Title	Indicator ⁽¹⁾	Definition of Numerator
1. Complete set of forms on chart	Number of complete medical records in sample, divided by total sample size	The total number of medical records in the sample with all the forms required at final admission (001, 003, 006, 015, 017, 020, 024, 051)
2. Correct chart headers	Number of medical records in sample with all chart headers correct divided by total sample size	The total number of medical records in the sample with all the chart headers correct. (That is, at final admission the patient's name, surname, and medical record number were all recorded on forms 005, 006, 015, 020, 024, 051, and lab tests.)
3. Complete discharge form	Number of completed discharge forms in sample divided by total sample size	The total number of medical records in the sample that have the discharge form completed, including medical record number, provisional diagnosis, primary final diagnosis, days of hospitalization, condition at discharge, physician or rotating intern's signature, and the result
4. Complete delivery record	Number of medical records in sample with the delivery record complete divided by total sample size	The total number of medical records in the sample with complete delivery records: medical record number, age of patient, date and time of birth, status of delivery (e.g., live birth), blood group and factor, and sex of newborn
5. Patient consent for treatment and release authorization forms	Number of medical records in sample with a signature on the authorization forms divided by total sample size	The total number of medical records in the sample that had patient/designee signatures on the authorization forms
6. Identification (ID) on admission and discharge forms	Number of medical records in sample with the patient's civil ID number on the admission and discharge forms divided by total sample size	The total number of medical records in the sample with the patient's civil ID number on the admission and discharge forms
7. Legible	Number of medical records in sample with legible medical notations with respect to the indications, diagnosis, and progress notes divided by total sample size	The total number of medical records in sample with legible medical notations with respect to the indications, diagnosis, and progress notes. Legible documentation was defined as writing that can be clearly understood on forms 001, 005, 006, 008, 015, and 005, with respect to the name of the patient, medical record number, diagnosis, medical indications, and progress note.
8. Coherent and consistent	Number of medical records in sample that were coherent and consistent in content divided by total sample size	The total number of medical records in the sample that contained entries that were coherent and consistent, that is, they coincided with the diagnosis on form 015 or 005, discharge, 001, the cesarean protocol (if applicable) and that were in chronological sequence and related to the progress notes

Note: 1. Each indicator is the ratio of the number of correct medical records in the sample as defined in the right column (the "numerator") to the total number of medical records in the sample (the "denominator").

obtained on a ninth standard, provider signatures, but not reported here because the data are incomplete. Each indicator is the proportion of all records sampled that met the associated standard. For example, indicator 1 depicts the proportion of all sample medical records that contained a complete set of obstetric forms.

Data collection. A sample of medical records was audited at each participating hospital before and after the new system was implemented. The study was limited to medical records of obstetric patients who were identified through a monthly report. Thirty records were selected randomly from the report for each targeted month. Approximately four months were targeted for the pre- and post-periods, although this varied among the hospitals. The authors reviewed all selected records and recorded data on a study data collection form. The pre-sample had 448 records (ranging from 76 to 133 per hospital), and the post-sample had 459 (80 to 131 per hospital).

Analysis. All quantitative data were entered and summarized by indicator and hospital using SPSS and EPI-INFO. The statistical significance of pre- and post-differences by hospital and indicator were determined using a 2-tailed chi-square test in EXCEL.

IV. Results

A. Specific Actions Resulting from the Redesign Process

Although the redesigned documentation systems are best understood as a whole, various specific actions are noteworthy. These actions have been categorized as effecting the structure or the process of the system. Actions related to system structure included:

- Presentation of the baseline data to the hospital management and department heads
- Advocacy activities with the hospital and provincial directors
- Development of a policy and procedures manual for the use, management, completion, processing, analysis, storage, and archiving of the clinical record
- Creation of a learning center at one hospital for effective management of the clinical record, with a donation of teaching materials and a projector
- Adding space to the data processing area
- Donation of computers
- Signage
- Development of a transfer form
- Revision of nursing documentation forms
- Supervisors' guide

Actions related to system process included:

- Training teams in the quality redesign method

- Training hospital staff in the documentation policy and procedures manual
- Training selected medical record staff in the International Statistical Classification of Diseases and Related Health Problems (CIE-10)
- Implementing 24-hour service in the medical record department at two hospitals
- Implementing a model for making appointments in the external consult area for mothers

In addition, each hospital selectively monitored the effectiveness of additional interventions made after the original redesign was implemented.

B. Impact of the Redesigned Systems on the Quality of Medical Records

The results by hospital and indicator are summarized in Table 5. For the entire sample pooled across the four hospitals, average adherence to the eight standards increased from 41 percent before to 68 percent after the changes were implemented. This increase of nearly 27 percentage points was highly significant ($p < .001$).

By indicator. In the four-hospital pooled analysis, five of the eight quality indicators showed substantial (greater than 20 percentage points) and highly significant ($p < .001$) increases. For the remaining three indicators, one (patient consent) increased by 10 percentage points, and two showed no significant change (chart header, patient identification on admission and discharge forms). The five

Table 5
Summary of Improvements by Hospital and Pooled:
Number and Percentage of Medical Records Meeting Quality Standards

Quality Indicator	Riobamba				Ambato				Pillaro				Ibarra				Pooled Total ^[3]			
	Pre (%)	Post (%)	Gain ^[1] pp	p-value ^[2]	Pre (%)	Post (%)	Gain pp	p-value	Pre (%)	Post (%)	Gain pp	p-value	Pre (%)	Post (%)	Gain pp	p-value	Pre (%)	Post (%)	Gain pp	p-value
Sample size	120	131			119	126			76	80			133	122			448	459		
1. Complete set of forms	23 (19.2)	99 (75.6)	56.4	<.001	104 (87.4)	126 (100)	12.6	<.001	0 (0.0)	76 (95.0)	95.0	<.001	68 (51.1)	96 (78.7)	27.6	<.001	195 (43.5)	397 (86.5)	43.0	<.001
2. Chart header	114 (95.0)	94 (71.8)	-23.2	<.001	114 (95.8)	104 (82.5)	-13.3	<.001	76 (100)	64 (80.0)	-20.0	<.001	54 (40.6)	82 (67.2)	26.6	<.001	358 (79.9)	344 (74.9)	-5.0	=.074
3. Complete discharge form	72 (60.0)	131 (100)	40.0	<.001	15 (12.6)	123 (97.6)	85.0	<.001	7 (9.2)	75 (93.8)	84.5	<.001	23 (17.3)	121 (99.2)	81.9	<.001	117 (26.1)	450 (98.0)	71.9	<.001
4. Complete delivery record	3 (2.5)	63 (48.1)	45.6	<.001	4 (3.4)	108 (85.7)	82.4	<.001	2 (2.6)	23 (28.8)	26.1	<.001	73 (54.9)	78 (63.9)	9.0	<.001	82 (18.3)	272 (59.3)	41.0	<.001
5. Patient consent	67 (55.8)	94 (71.8)	15.9	=.009	96 (80.7)	119 (94.4)	13.8	=.001	1 (1.3)	1 (1.3)	0.0	=.971	15 (11.3)	17 (13.9)	2.7	=.522	179 (40.0)	231 (50.3)	10.4	=.002
6. ID on admission and discharge forms	29 (24.2)	32 (24.4)	0.3	=.962	3 (2.5)	2 (1.6)	-0.9	=.605	1 (1.3)	1 (1.3)	0.0	=.971	0 (0.0)	15 (12.3)	12.3	<.001	33 (7.4)	50 (10.9)	3.5	=.065
7. Legible	31 (25.8)	96 (73.3)	47.4	<.001	60 (50.4)	105 (83.3)	32.9	<.001	50 (65.8)	59 (73.8)	8.0	=.279	109 (82.0)	112 (91.8)	9.8	=.021	250 (55.8)	372 (81.0)	25.2	<.001
8. Coherent and consistent	71 (59.2)	111 (84.7)	25.6	<.001	68 (57.1)	121 (96.0)	38.9	<.001	29 (38.2)	31 (38.8)	0.6	=.939	90 (67.7)	114 (93.4)	25.8	=.015	258 (57.6)	377 (82.1)	24.5	<.001
Total ^[4] / (Average)	410 (42.7)	720 (68.7)	26.0	<.001	464 (48.7)	808 (80.2)	31.4	<.001	166 (27.3)	330 (51.6)	24.3	<.001	432 (40.6)	635 (65.1)	24.5	<.001	1472 (41.1)	2493 (67.9)	26.8	<.001

Notes: 1. Gain is in percentage points. 2. p-value based on 2-tailed chi-square test. 3. Pooled totals combine data from all four hospitals into a single sample, with each hospital weighted according to its sample size. 4. Subject to rounding errors.

indicators with large and highly significant increases were:

- Complete set of forms
- Complete discharge form
- Complete delivery record
- Legible
- Coherent and consistent

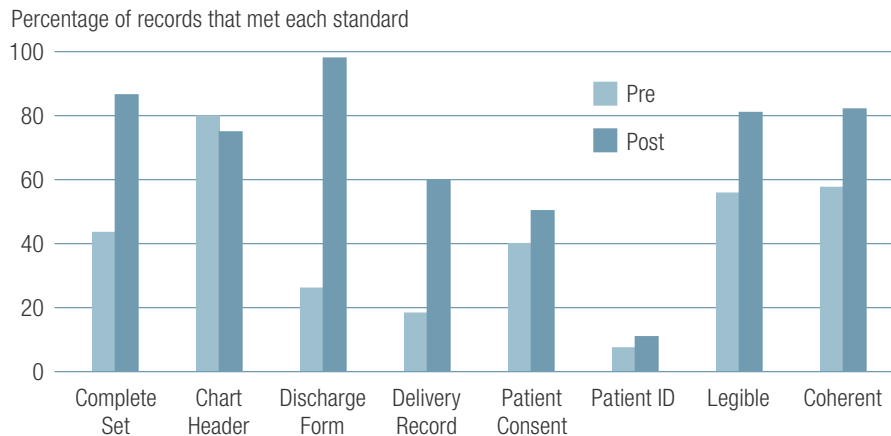
The pre-intervention performance of these five indicators for the four-hospital pooled sample ranged from 18.3 to 57.6 percent. The pre-to-post increase across the five indicators

ranged from 24.5 to 71.9 percentage points. This resulted in four of the five high-impact indicators finishing with pooled scores over 80 percent (Figure 4). The laggard among the five high impact indicators was “complete delivery record” which started low (18.3 percent), and although it experienced a highly significant gain of 41 percentage points, achieved only 59.3 percent adherence to standard after the intervention. Interestingly, one of the two indicators not affected by the intervention started low and stayed

low: “Identification (ID) on admission and discharge form” scored 7.4 percent before and 10.9 percent after the intervention, while the second, “chart header,” started high (79.9 percent) and stayed high (74.9 percent).

By hospital. The eight-indicator average pre-intervention score and pre-to-post gain show only small variations among the four hospitals (Table 5 and Figure 5). Pillaro had the lowest average pre-intervention score (27.3 percent) and smallest

Figure 4
Pre- and Post-Performance on Eight Documentation Indicators:
Pooled Sample, All Hospitals

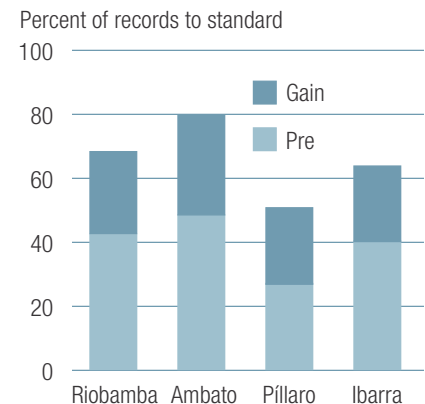


gain (24.3 percentage points), while Ambato had the highest pre-intervention score (48.7 percent) and largest gain (31.4 percentage points). The difference in average gain among the four hospitals was not significant.² As seen in Figure 5, hospitals with progressively higher

average indicator scores in the pre-survey yielded progressively higher gains following the intervention.

The general pattern observed for the indicators in the pooled sample was not found at each individual hospital. Several indicators that showed strong gains in some hospitals

Figure 5
Average Performance across
Eight Documentation
Indicators, by Hospital



Note: Hospitals are shown in the order in which they implemented the program: Riobamba first, Ambato and Pillaro second, and Ibarra third.

showed weak gains in the others. However, some insights emerge by focusing on the pre-intervention performance gap (the proportion of all records that did not meet a particular standard) in the five indicators that had substantial gains. Table 6 summarizes how much of the performance gap was closed by the pre-to-post gain for the five high-gain indicators. Ambato closed most of the gap in all five indicators, while Pillaro made up most of the gap in only two. The failure of Pillaro to improve the coherency indicator stands out. Looking at the same data by indicator rather than by hospital reveals that all four hospitals nearly closed the gap in the “complete discharge form” indicator, but gap reduction was less consistent in the other indicators.

Table 6
Reduction in Performance Gap^[1] Following Intervention

Indicator ^[2]	Riobamba	Ambato	Píllaro	Ibarra
Complete set of forms	0.70	1.00	0.95	0.56
Complete discharge form	1.00	0.97	0.93	0.99
Complete admission record	0.47	0.85	0.27	0.20
Legible	0.64	0.66	0.23	0.54
Coherent and consistent	0.63	0.91	0.01	0.80

Notes: 1. “Performance gap” is the proportion of all records in the pre-intervention sample that do not meet a particular standard. The data reflect the proportion of the performance gap eliminated by the intervention. For example, “1.00” indicates that all of the gap was eliminated; “.70” indicates that 70% was eliminated. 2. These five indicators showed substantial and statistically significant gains following the intervention.

² A chi-square test of the difference among the percentage point gains applied to the post-sample size was calculated and produced a p-value of 0.57.

C. Changes in the Redesign Methodology

Redesign teams at the four hospitals generally identified similar problems with the methodology, such as:

- Team members were not punctual in attending workshops
- The workshops were not long enough to cover the material
- Workshops were sometimes scheduled at inconvenient times that conflicted with team members' work responsibilities
- Workshop space was inadequate in some hospitals
- The situational analysis lacked certain useful content information, especially related to the location and adequacy of space for the medical record function

Key recommendations for improvement included: make workshops longer, obtain more and better space for workshops and redesign team work, increase punctuality, and have larger redesign teams.

The QA facilitators noted problems similar to those identified by the redesign teams. They all thought that most of the redesign team members were very participatory in the workshops and that hospitals generally provided adequate logistical support. The primary recommendation was to allow more workshop time.

With some noteworthy exceptions, the problems identified were not resolved in the later applications of the redesign methodology. Problems of punctuality continued throughout, inadequate time for workshops remained a problem until the end, and content issues with the situational analysis remained. However, the lack of space at the first hospital

was solved in the last three applications, and towards the end of the final application (Ibarra), redesign team members said that the time was adequate. The best example of methodology refinement relates to how the first three workshops were conducted. In the first hospital, Riobamba, the methodology assessment indicated that the first three redesign workshops were too theoretical, rendering the information difficult to apply. The recommended changes included identifying the clients' needs after the team understands the theory and using practical exercises with a fictitious theme to teach the methodology. Based on the recommendations, the following changes in the methodology were implemented:

- In workshops 1 and 2, train up to step 3 only
- After workshop 2, collect the data regarding client needs
- Next develop a list of questions regarding client needs and benchmark at various institutions
- Use a practical exercise in small groups with a fictitious theme to teach steps 5–7
- Next, discuss experiences with benchmarking and review the baseline data
- Conduct two workshops of four hours each to complete the design process: in the first, present the clients' needs, develop the first-level flowchart, and match needs with the blocks of activities. In the second, define the key elements of the design and develop the second-level flowchart

The revised methodology was implemented and in turn evaluated by the study teams at the next two

hospitals (Ambato and Pillaro). No further changes were recommended. Accordingly, the same revised redesign methodology was used at the final hospital (Ibarra).

Although this example clearly shows that the redesign methodology was refined for subsequent hospitals, the impact of the improvements seems to have been negligible. Adherence to documentation standards at the conclusion of the exercise does not seem to have been better in the later hospitals. There does not appear to be any relationship between the order in which the hospitals entered the program and the size of the average quality gain in the hospital (see Table 3 and Figure 5).

V. Discussion

As in previous studies regarding documentation in medical records, various deficiencies were identified in the documentation system in the Ecuadorian hospitals. Prior to the study, discharge summary completion ranged from 9.2 to 60 percent in the Ecuadorian hospitals. This finding was consistent with a study conducted in Hong Kong (Chisholm et al. 1994) in which the overall accuracy of documentation on the discharge summary was 60 percent. Completion of information on the delivery record was only 2.5 to 55 percent in the Ecuadorian hospitals studied, and legibility of documentation was 26 to 82 percent. Studies reviewed by Callen et al. (1997) all drew similar conclusions: medical staff failed to complete the required documentation adequately.

In one of the study hospitals, the archiving process was severely hindered by inadequate space. Obsolete record maintenance and

problems in the chart control process led not only to delays in record completion but also to the unavailability of records for delivery of care. Not being able to obtain records during off hours was a significant barrier to emergency department staff, in that they could not access the previous records to determine prior history and treatment. Consequently, 24-hour accessibility to records was identified as an important issue in two hospitals in this study; they redesigned their systems to meet this need.

Medical records are often poorly designed (Wyatt and Wright 1998), making it difficult to gain a rapid overview of the clinical problems. The Ecuadorian physicians identified a problem with obtaining adequate information when receiving/transferring patients, and the nurses identified problems with forms that required duplicate data. The consistency of information on the various obstetric forms ranged from 38.2 to 62 percent, so it behooved them to find ways to improve documentation and reduce duplication. A new transfer form was designed as well as a new form for nursing notes. These new forms hopefully will address the problems and provide better information for making patient care decisions.

The redesign methodology was expected to improve various aspects of the documentation process in all of the Ecuadorian hospitals, but we did not anticipate the exciting benefits of the redesign approach. For instance, by working on a redesign effort, an interdisciplinary group at the hospital evolved into an active team that assumed responsibility for implementing

change. Their enthusiasm for the process provided the stimulus to continue the work even in the face of a national economic crisis and multiple transportation and health worker strikes. Many of the team members participated on their own time and crossed picket lines to attend the redesign workshops.

All the teams worked with financial constraints. The redesign process was initiated with the knowledge that no additional resources could be expected. However, this challenge seemed to inspire the teams to be creative. One example is a team that saw the need for more space for the medical record department and wanted to begin computerizing the admission process. Through investigation, they found that many of the records in storage no longer had to be retained. They sold a room full of old medical records to a paper company and generated enough money to buy a computer. Thus they accomplished their goals of recouping space in the medical record department and obtaining a computer.

VI. Conclusions

This study demonstrated that the redesign methodology can be effective in improving documentation in hospitals in Ecuador. All four participating hospitals improved substantially on most indicators of documentation quality. However, it is unclear whether the sequential learning process, in which each team assessed the redesign methodology it had used and recommended modifications, was successful. Each hospital did generate a few practical sugges-

tions for modifications of the methodology, but since there was only one iteration of such modifications and no discernable difference in results at the three hospitals where the revised methodology was used, the sequential learning appears not to have had an impact.

This study also provides insights into the factors that contribute to an effective redesign methodology. In particular, when selecting redesign, the magnitude of the problems needs to warrant the effort. In addition, there must be a commitment from the leadership to support the team in the process. Time must be allotted for meetings, data gathering, and implementing change. Further, teams need the guidance of someone trained in the redesign process. The method used in this study not only guided the teams through the process but also taught them how to apply the process so that after the study, the teams could apply the method to other services.

Future studies should investigate whether improved patient records can be used for quality assessment and monitoring; whether they are more cost-effective for quality assessment than other methods; and whether the improved records lead directly to improved quality, for example by reducing clinical errors.

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